

The use of information technology applications in the provision of health care to a COVID-19 patients

Ihsan Ali Hassan¹, Ahmed Adnan Mohammed Al-Azzawi², Mohammed Layth Talal³

¹Department of Information Technology, College of Medicine, University of Diyala, Baquba, Iraq

²Department of Administrative and Financial Affairs, Diyala Presidency, University of Diyala, Baquba, Iraq

³Department of Economics, College of Administration and Economics, University of Diyala, Baquba, Iraq

Article Info

Article history:

Received Feb 19, 2022

Revised Jun 25, 2022

Accepted Jul 8, 2022

Keywords:

COVID-19
Information and
communications technology
Information technology
telemedicine
Pandemic

ABSTRACT

At the time of writing this study, the COVID-19 virus continues to spread through its multiple mutants, the latest of which is (Omicron). Therefore, it was necessary to use effective and unconventional treatments to reduce the spread of this virus and to deliver health care to its infected without the need to be exposed to the risk of infection. This research paper presents valuable solutions for communicating with COVID-19 patients through the use of information technology applications. This method contributes to reducing the consumption of medical resources, reducing contact with patients, and helping with social distancing, which contributes to reducing the spread of this virus. The process of using information technology means to provide medical advice and treatment to patients by telemedicine doctors has been clarified. More importantly, the results of this study presented the factors affecting the use of these applications in terms of social, technological, and organizational.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Ihsan Ali Hassan

Department of Information Technology, College of Medicine, University of Diyala

Baquba, Diyala Governorate, Iraq

Email: ihsan@uodiyala.edu.iq

1. INTRODUCTION

In the first quarter of 2020, the World Health Organization (WHO) announced the outbreak of the Corona epidemic (COVID-19) [1]. With more than half a million cases of the epidemic reported in more than 200 countries around the world, as of the beginning of March of the year 2020. Due to the spread of the Corona epidemic, countries have closed their doors to their visitors, and its residents were advised to self-quarantine, which led to a change in its society, its economy, and the health care system [2]. This pandemic has led to great pressure on the health staff and increased the risk of infection of this staff with this epidemic as a result of infection from the infected, in addition to a severe shortage of medical resources. From all of this, the need for innovative ways to keep pace with the treatment of this virus emerged, and among these methods, which are discussed in this paper, is the use of information technology applications [3].

It is possible to rely on information technology means, including programs and applications connected to the Internet, to provide remote medical services for patients infected with the Coronavirus, which allows to reduce physical human interaction and thus reduce infection with this epidemic [4]. Information and communication technology (ICT) means represents a reasonable option that can be used to manage this epidemic, as the Corona epidemic crisis posed a serious challenge in providing health care to patients, which stimulated the rapid use of information technology applications to provide remote medical care [5].

As a precautionary measure, all countries of the world, during of this pandemic, have imposed social distancing and quarantine in order to stop the spread of this virus among their residents. In order to deliver medical services to patients with this virus who are quarantined in their homes, this study suggested the use of information technology applications to deliver medical advice and services to these people. In addition to the above, applications and programs of ICT can be used within hospital wards (for example, doctors guided the health staff in the halls of patients with COVID-19 and give them medical instructions remotely, thus limiting the spread of this pandemic) [6]. This research paper presents solutions and recommendations related to the impact of providing healthcare to patients of the coronavirus remotely (this is called telemedicine), which contributes to reducing the spread of this pandemic.

2. OBJECTIVES

The goal of this research paper is to prove the possibility of benefiting from modern information technology applications in the delivery of health care and medical advice to patients with COVID-19 remotely, which leads to mitigating the spread of infection as a result of reducing the momentum of health centers and hospitals and reducing contact between patients of this epidemic and health staff healer. Also, it contributes to reducing the consumption of medical resources. In addition, the use of information technology means helps in social distancing to prevent the spread of this epidemic

3. METHOD

Since the beginning of the Corona epidemic, patients with this virus have suffered from the fear of the medical staff of transmitting the infection to them, the lack of medical advice, and the complete closure of all life facilities, which negatively affected the delivery of health care to them [7]. In addition, many of those patients lost their lives, which frightened the population. From the foregoing, it was necessary to suggest some solutions to these problems resulting from this pandemic and to mitigate its effects on patients with this virus in particular [8]. In this research paper, an accurate review of the sources related to providing medical and clinical services remotely during the Corona pandemic period was used, and these sources varied from scientific reports, conference proceedings, and scientific papers published in international journals that were cited in the references section. The process of searching for these sources was carried out through the websites of these journals on the Internet and within the databases of Scopus, IEEE Xplore, ISI, Springer, and others, as well as ResearchGate and Google Scholar websites. The search method was done by choosing the advanced options in the search to make the results more accurate, as the search was done using the most relevant words “COVID-19”, “telemedicine”, “pandemic”, “IT health”, “corona”, “electronic health”. Figure 1 shows the structure of the research that used in this paper.

As a result of searching the databases of the scientific journals mentioned above, nearly 70 research articles and papers were collected. After reviewing all these researches, approximately 25 papers were selected after excluding articles that did not provide answers to the research questions for this study. The selected research papers have been adapted to provide evidence about the use of information technology applications in providing remote health care for patients with the emerging coronavirus, as this research paper aims to answer the following research questions:

- i) How to adopt information technology applications to provide health care to patients with the emerging Coronavirus?
- ii) How important is the application of information technology platforms and programs in providing remote medical advice to patients with the Coronavirus?
- iii) What are the applications and programs that can be used to provide telehealth for patients with the Coronavirus?

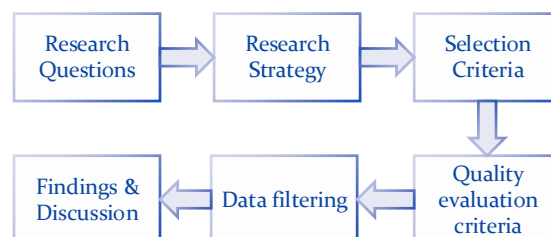


Figure 1. Illustrates the research structure used in this study

4. RESULT AND DISCUSSION

4.1. Findings

Information technology applications that are used to provide remote care and medical advice to patients with COVID-19, use real-time interactive data and communications to provide care, medical advice, diagnosis, and treatment for patients with this virus. Communication between doctors and patients is done through the use of smartphones or computers connected to the Internet via voice and video calls [9], [10].

The use of information technology means to deliver health care to Corona patients reduces the possibility of medical staff being exposed to the risk of infection with the disease. At the same time, patients can communicate with their doctors remotely through electronic communication platforms via smartphones or computers, which allow patients to be examined remotely before they come to the hospital [11]. These electronic means can encourage self-quarantine and reduce the number of patients visiting the hospital, and thus encouraging social distancing. In addition to the aforementioned, the use of electronic means of communication has reduced the use of personal protection methods and provided isolated contact for patients with their families and friends. Accordingly, doctors found an urgent need to communicate with their patients in electronic ways that are accessible to everyone and provide video communication (for example, Skype, Zoom Meeting, Facetime, Viber, Webex, and WhatsApp) [12].

According to many sources, adopting the use of information technology applications in providing medical care and advice to patients with COVID-19 helps in many aspects that can be summarized as follows [13]-[15]:

- i) The speed at which the patient obtains a diagnosis, and thus the speed of initiation of treatment.
- ii) Facilitating the follow-up process for Corona patients (who can be monitored remotely while they are in their homes), which leads to reducing overcrowding in health facilities.
- iii) As long as patients receive telehealth, this reduces the risk of infection spreading to health staff.
- iv) Reducing the financial costs of disinfectants, sterilizers, gloves, or any other materials used for the purpose of preventing infection.
- v) Giving training courses to new medical staff to qualify them to treat COVID-19 patients.

4.1.1. Using IT applications in treating Coronavirus patients

The use of information technology platforms in the delivery of health care to coronavirus patients provides the medical staff with reliable information, which makes the treating doctors obtain accurate information in real-time [16]. Figure 2 illustrates the process of using Information technology (IT) applications to treat COVID-19 patients.

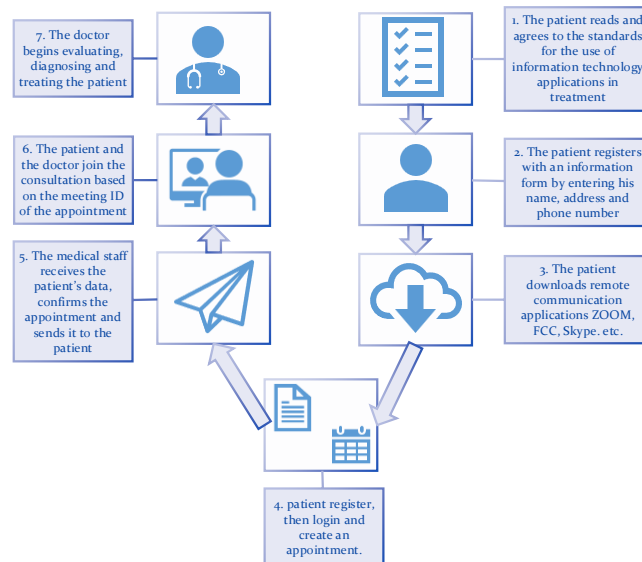


Figure 2. Illustrates the process of using IT applications to treat COVID-19 patients

This process helps to store patient data, whether images or videos, which can be viewed by the treating physician at the same time or at a later time. Remote communication between Corona patients and treating doctors is of two types: synchronous (the patient and the treating doctor are communicating at the

same time using video conferencing applications such as ZOOM, Skype, and FCC), or asynchronous (the communication between them is not simultaneously using e-mail, or electronic advice) [17].

During this unique pandemic, patients with this virus are happy to obtain virtual health care without leaving their homes (doctors advised to self-quarantine for those whose cases do not require admission to the hospital). As for critically ill patients, health care must be provided to them in a physical way and not from a distance, while taking all precautions for equipment that prevents transmission of infection to the medical staff (wearing masks, using disinfectants, and wearing gloves) [18]. To this day, when writing this research paper, the world faces the multiple mutants of this virus, which are not much different from its beginnings, as it is almost three years since the beginning of declaring it a pandemic that swept the world, so the need has increased to adopt unconventional means to reduce its effects and deliver health care to its patients. These technological means are numerous from smartphone platforms and applications that provide simultaneous visits that enable video and audio communication and are easy to use for both parties, and doctors while maintaining patient privacy, in addition to applications that perform the functions of measuring temperature and oxygen in the blood, which the patient performs measured by himself [19].

4.1.2. Factors that affect the use of information technology means in treating patients with COVID-19

As we mentioned previously, the use of information technology applications as well as electronic platforms to communicate and provide consultations and treatment for Corona patients remotely represents a practical and appropriate option in the face of this pandemic. However, the success of using these means needs to provide conditions represented in providing an integrated infrastructure for information technology, training the medical staff to use these technologies, an amendment to the hospital's work mechanism, and taking into account the privacy of patients [20]. Accordingly, this paper discusses the social, technological, and organizational factors that influence the use of information technology applications by clinicians and patients alike. Where Figure 3 summarizes these factors.

a) Social factors

From a social point of view, there are several aspects that have an impact on the use of information technology applications in treating Corona patients from a distance. These aspects can be summarized as follows [21]:

- Licensing requirements: A doctor can, through licensing requirements, practice his profession in his country of residence (and these requirements differ from one country to another). Therefore, the treating physician must be licensed to work in the country in which the patient is located. In the period of this pandemic, it is necessary to suspend these requirements to make room for remote treatment of patients.
- Health insurance: Most of the health insurance applied in countries, including developing countries, does not cover the cost of providing treatment remotely. Consequently, the spatial restrictions of health insurance must be liberated in response to the Corona pandemic.
- Patient and doctor conviction: One of the reasons for the limited reliance on information technology applications in treating corona patients is the unwillingness of doctors to this type of medicine due to their lack of sufficient knowledge and training to use information technology means. The same applies to patients, as hospitals do not rely on this type of treatment because patients are not well aware of virtual application platforms. Furthermore, the patient must agree to video and audio communication with the doctor [22].

b) Technological factors

- Patient data privacy: Protecting the privacy of Corona patient data is critical and very important to the success of this experiment. As it is known, some virtual communication applications do not protect users' data from access or maintain their privacy. Therefore, we must not overstep the protection of privacy, but during this pandemic, it is possible to access patient data without obtaining their consent, but only temporarily until the effect of this virus is removed [23].
- IT infrastructure: It is considered the most important element in this part, which represents the biggest obstacle to the use of information technology in providing remote treatment for Corona patients. The information technology infrastructure is the audio-visual equipment used in communication and the availability of a fast and continuous network in real-time, which is considered a challenge in developing countries.
- Data security: The use of information technology applications in the remote treatment of Corona patients includes the digital transmission of patient data and its access to the treating doctors. The transmission of this sensitive data must be safe and secure. Where it is possible that the application used

has sponsorship from certain companies and thus patient data is exposed to use by advertisers who send their advertisements to patients who use this application.

c) Organizational factors

- The funding: For the success of any idea in any field, it is necessary to provide the necessary funding for this project. Funding is required to support the development of applications used in the provision of telemedicine and to provide the tools required for remote communication. In addition to supporting the process of training medical personnel to deal with information technology means. For these reasons, the lack of funding is an obstacle to the adoption of the use of information technology in treating Corona patients from a distance [24].
- Training: Training patients and doctors alike to use information technology applications is one of the factors influencing the application of the telemedicine model. Thus, in-person or electronic training courses must be conducted and are always available for use when needed. Where many sources mentioned that the lack of training affects the adoption of this idea [25].
- Work regulation: The process of treating Corona patients from a distance using information technology applications must be regulated by special laws that merge with the rules followed in hospitals. This leads to the integration of health care practices approved in hospitals with those that provide.

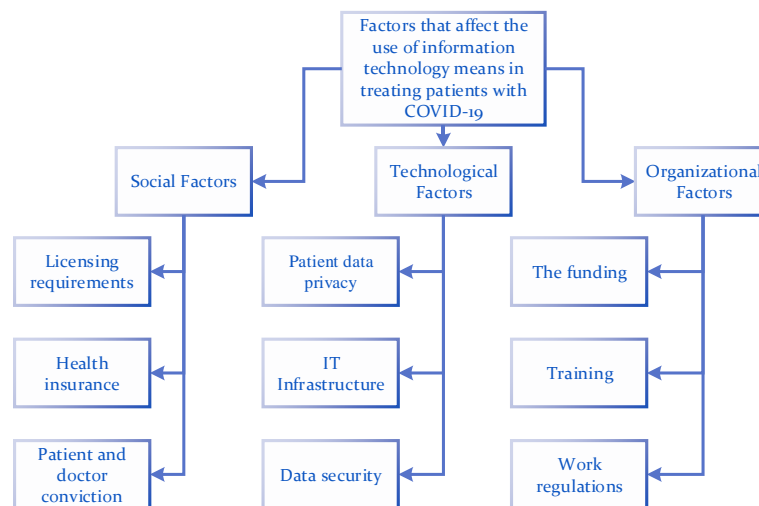


Figure 3. Factors that affect the use of information technology means in treating patients with COVID-19

4.2. Discussion

The use of information technology means to deliver health care to Corona patients reduces the possibility of medical staff being exposed to the risk of infection with the disease. At the same time, patients can communicate with their doctors remotely through electronic communication platforms via smart phones and computers, which allow patients to be examined remotely before they come to the hospital. These electronic means can help preserve the medical resources of hospitals, protect the staff of these health institutions from infection with the virus, as well as support patients [26].

In addition, this paper describes the process of adopting the use of information technology applications in the process of treating Corona patients remotely, as this adoption provides patients with synchronous and asynchronous communication with their physicians. It is expected that this experience will affect the creation of future opportunities to access health care even after this pandemic, and in turn, this experience affected the organizational structure in providing health care to facilitate support for remote treatment, which will be difficult to reverse after the Corona pandemic. In recent years, the world has begun to turn to this type of medicine for several reasons, including the development in electronic communication applications, and social media has become a part of our routine. Although adopting the use of information technology platforms in the treatment of COVID-19 patients does not guarantee complete protection from this epidemic, but it is useful in treating COVID-19 patients. From all this, the use of IT applications can help mitigate the impact of this virus and reduce its spread.

5. CONCLUSION

When reviewing this research paper, we can conclude that it is necessary to use applications and means of information technology in the delivery of health care to patients infected or suspected of being infected with COVID-19 from a distance. Moreover, these methods are safe, effective, convenient and can be developed. In addition, the results prove that the technology of telemedicine treatment of patients has a major role in helping to prevent the spread of infection with the virus. The results from this article indicate the impact of technological, social and organizational factors on the implementation of the use of information technology applications in the remote treatment of COVID-19 patients. There are some shortcomings in this study about the lack of use of primary data in verifying the factors affecting the use of information technology, which were classified as social, technological and organizational, so it will be in future studies to verify the actual impact of these factors on the use of information technology applications in treating COVID-19 patients remotely.




REFERENCES

- [1] M. W. Hasan, "Covid-19 fever symptom detection based on IoT cloud," *International Journal of Electrical and Computer Engineering*, vol. 11, no. 2, pp. 1823-1829, 2020, doi: <http://doi.org/10.11591/ijece.v11i2.pp1823-1829>.
- [2] C. Z. Li, E. M. Borycki, and K. W. Andre, "Connecting the world of healthcare virtually: a scoping review on virtual care delivery," *Healthcare*, vol. 9, no. 10, p. 1325, 2021, doi: [10.3390/healthcare9101325](https://doi.org/10.3390/healthcare9101325).
- [3] M. Alam, R. Parveen, I. R. Khan, and J. Hamdard, "Role of information technology in COVID-19 prevention," *International Journal of Business Education and Management Studies (IJBEMS)*, vol. 5, no. 1, pp. 65-78, 2020.
- [4] E. P. Manalu, A. Muditomo, D. Adriana, Y. Trisnowati, Z. P. Kesuma, and R. H. Dwiyani, "Role of information technology for successful responses to covid-19 pandemic," *2020 International Conference on Information Management and Technology (ICIMTech)*, 2020, pp. 415-420, doi: [10.1109/ICIMTech50083.2020.9211290](https://doi.org/10.1109/ICIMTech50083.2020.9211290).
- [5] A. Asadzadeh, S. Pakkhou, M. M. Saeidabad, H. Khezri, and R. Ferdousi, "Information technology in emergency management of COVID-19 outbreak," *Informatics in Medicine Unlocked*, vol. 21, p. 100475, 2020, doi: [10.1016/j.imu.2020.100475](https://doi.org/10.1016/j.imu.2020.100475).
- [6] I. A. Hassan, A. A. Mohammed, and N. O. Abdulwahid, "Proposed medical cloud computing for iraqi health institutions," *Journal of Engineering and Applied Sciences*, vol. 14, no. 10, pp. 3354-3358, 2019, doi: [10.36478/jeasci.2019.3354.3358](https://doi.org/10.36478/jeasci.2019.3354.3358).
- [7] H. R. Fajrin, B. S. Adi, H. Purwoko, and I. P. Sari, "Telemedicine-equipped android interface-based heart rate monitoring," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 21, no. 3, pp. 1332-1340, 2021, doi: [10.11591/ijeecs.v21i3.pp1332-1340](https://doi.org/10.11591/ijeecs.v21i3.pp1332-1340).
- [8] M. Ulivi *et al.*, "Remote management of patients after total joint arthroplasty via a web-based registry during the COVID-19 pandemic," *Healthcare*, vol. 9, no. 10, p. 1296, 2021, doi: [10.3390/healthcare9101296](https://doi.org/10.3390/healthcare9101296).
- [9] J. H. Wright and R. Caudill, "Remote treatment delivery in response to the COVID-19 pandemic," *Psychotherapy and Psychosomatics*, vol. 89, pp. 130-132, 2020, doi: [10.1159/000507376](https://doi.org/10.1159/000507376).
- [10] S. Hashim, A. Masek, N. A. Saadah, A. N. Paimin, and W. M. N. W. Hanim, "Students' intention to share information via social media: a case study of COVID-19 pandemic," *Indonesian Journal of Science & Technology*, vol. 5, no. 2, pp. 236-245, 2020, doi: [10.17509/ijost.v5i2.24586](https://doi.org/10.17509/ijost.v5i2.24586).
- [11] O. AlShorman, B. Alshorman, M. Masadeh, F. Alkahtani, and B. Al-Absi, "A review of remote health monitoring based on internet of things," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 22, no. 1, pp. 297-306, 2021, doi: [10.11591/ijeecs.v22i1.pp297-306](https://doi.org/10.11591/ijeecs.v22i1.pp297-306).
- [12] S. Banskota, M. Healy, and E. M. Goldberg, "15 smartphone apps for older adults to use while in isolation during the COVID-19 pandemic," *Western Journal of Emergency Medicine*, vol. 21, no. 3, pp. 514-525, 2020, doi: [10.5811/westjem.2020.4.47372](https://doi.org/10.5811/westjem.2020.4.47372).
- [13] I. A. Hassan, A. A. Mohammed Al-Azawi, and M. L. Talal, "Evaluation of e-health records system: case study albatool teaching hospital in Iraq," *AIP Conference Proceedings*, vol. 2386, no. 1, p. 050023, 2022, doi: [10.1063/5.0066977](https://doi.org/10.1063/5.0066977).
- [14] D. Jayasinghe, R. M. Crowder, and W. Gary, "Model for the adoption of telemedicine in Sri Lanka," *SAGE Open*, vol. 6, no. 3, 2016, doi: [10.1177/2158244016668565](https://doi.org/10.1177/2158244016668565).
- [15] T. Saxena, R. Srivastava, and C. Chandra, "Role of telemedicine in COVID-19 pandemic – an overview," *Asian Journal of Oral Health and Allied Sciences*, vol. 12, no. 1, pp. 1-4, 2022, doi: [10.25259/AJOHAS_10_2021](https://doi.org/10.25259/AJOHAS_10_2021).
- [16] N. N. Sari, M. N. Gani, R. A. M. Yusuf, and R. Firmando, "Telemedicine for silent hypoxia: Improving the reliability and accuracy of Max30100-based system," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 22, no. 3, pp. 1419-1426, June 2021, doi: [10.11591/ijeecs.v22i3.pp1419-1426](https://doi.org/10.11591/ijeecs.v22i3.pp1419-1426).
- [17] M. C. Tai, "The question of justice in treating the COVID-19 patients - has prioritizing the fittest to receive the treatment become the norm?," *Austin Anthropology*, vol. 4, no. 1, p. 1015, 2020.
- [18] P. Kanade, M. Akhtar, and F. David, "Remote monitoring technology for COVID-19 patients," *European Journal of Electrical Engineering and Computer Science*, vol. 5, no. 1, pp. 44-47, 2021, doi: [10.24018/ejece.2021.5.1.273](https://doi.org/10.24018/ejece.2021.5.1.273).
- [19] M. Kletečka-Pulker *et al.*, "Telehealth in times of COVID-19: spotlight on Austria," *Healthcare*, vol. 9, no. 3, p. 280, 2021, doi: [10.3390/healthcare9030280](https://doi.org/10.3390/healthcare9030280).
- [20] R. Miyauchi, K. Tanno, and H. Tamura, "Simple measurement system for biological signal using a smartphone," *International Journal of Electrical and Computer Engineering (IJECE)*, vol. 8, no. 6, pp. 4157-4163, 2018, doi: [10.11591/ijece.v8i6.pp4157-4163](https://doi.org/10.11591/ijece.v8i6.pp4157-4163).
- [21] Y. S. Abdalla, "Critical factors determining adoption of telemedicine," *International Journal of Online and Biomedical Engineering*, vol. 15, no. 11, pp. 124-138, 2019, doi: [10.3991/ijoe.v15i08.10492](https://doi.org/10.3991/ijoe.v15i08.10492).
- [22] J. K. Abed and H. M. Abed, "Smart monitor of pacemaker patient by using iot cloud in real time," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 18, no. 1, pp. 158-166, 2020, doi: [10.11591/ijeecs.v18i1.pp158-166](https://doi.org/10.11591/ijeecs.v18i1.pp158-166).
- [23] W. Wiharto, H. Kusnanto, and H. Herianto, "System diagnosis of coronary heart disease using a combination of dimensional reduction and data mining techniques: a review," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 7, no. 2, pp. 514-523, 2017, doi: [10.11591/ijeecs.v7i2.pp514-523](https://doi.org/10.11591/ijeecs.v7i2.pp514-523).
- [24] A. Thirunavukkarasu *et al.*, "Patients' perceptions and satisfaction with the outpatient telemedicine clinics during COVID-19 era in Saudi Arabia: a cross-sectional study," *Healthcare*, vol. 9, no. 12, p. 1739, 2021, doi: [10.3390/healthcare9121739](https://doi.org/10.3390/healthcare9121739).




- [25] N. A. Puro and S. Feyereisen, "Telehealth availability in US hospitals in the face of the COVID-19 pandemic," *The Journal of Rural Health*, vol. 36, no. 4, pp. 577-583, 2020, doi: 10.1111/jrh.12482.
- [26] R. R. Nadikattu, "Information technologies: rebooting the world activities during COVID-19," *SSRN*, 2020, doi: 10.2139/ssrn.3622733.

BIOGRAPHIES OF AUTHORS






Ihsan Ali Hassan    has (1st Teaching Award) in 2020 at the University of Diyala. His Bachelor's degree from the College of Sciences, Department of Computer Science, Almustenseria University - Iraq, and his Master's degree in Information Technology (IT) from the Natural and Applied Science Department, Cankaya University-Turkey. His area of interest includes analysis of information systems, problem-solving, design, and implementation of databases, and development of algorithms. Recently, his research interest is about analyzing patient data in hospitals and health centers in Iraq and proposing appropriate solutions to this huge amount of data. He can be contacted at email: ihsan@uodiyala.edu.iq.



Ahmed Adnan Mohammed Al-Azzawi    received his degree in Bachelor of computer science from Information Technology College-Iraq (2009), he has a Master's Degree in Information Technology (IT) from Cankaya University-Turkey (2015), the current work is a lecturer at the University of Diyala and specialist in administrative and financial affairs, the research trend in (IT), image processing, cloud computing, and e-management. He can be contacted at email: ad_ahmedal-azzawi@uodiyala.edu.iq.



Mohammed Layth Talal    his a Bachelor's degree from the College of Sciences, Department of Computer Science, Al Yarmok University College-Iraq, and his Master's degree in Information Technology (IT) from the Natural and Applied Science Department, Cankaya University – Turkey. His area of interest includes Information Security, the design and implementation of databases, development of algorithms. Recently, his research interest is about analyzing patient data in hospitals and health centers in Iraq and proposing appropriate solutions to this huge amount of data. He can be contacted at email: mohammedeco@uodiyala.edu.iq.